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THE INDUCTION MACHINE IN EASTERN EUROPE: A RESEARCH AGENDA

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Key words: Eastern European journals, Induction machine, IEC 60034-30 standard, Research trends, Systematic review.

This paper aims to offer an overview of the research on induction machines in Eastern Europe. To this end, it reviews all papers published on the topic between 2010 and 2017, in the six most prestigious Eastern European journals. The main findings show that: (1) researchers focus on the induction machine as used in electrical drives, their major research interest being the torque or speed control improvement; (2) in spite of the International Electrotechnical Committee's (IEC) new requirements to improve the efficiency of electric machines, this topic is almost inexistent among the studies published in Eastern European journals.

1. INTRODUCTION

The induction machine (IM), and in particular the IM operating as motor is one of the most used equipment in the industry due to its simplicity, robustness, long lifespan, and low manufacturing and maintenance costs. The IM as electric motor is built in a wide range of rated power from hundreds of watts to hundreds of kilowatts and could be found in various applications, such as fans, industrial or agricultural pumps, cranes, and so on. Moreover, along with an inverter power supply, it could be used in the electrical drives where the speed varies over a wide range [1, 2].

There have been attempts to review previous research on this topic, but they all focused on specific functional aspects of the induction machine. Most prior reviews focused on the induction machine faults, analyzing types of IM faults and ways to detect them [3, 4], and emphasizing either the rotor-related faults [5] or the stator-related faults [6]. Some reviewed prior studies that looked at optimizing the efficiency of induction machines [7–12]. However, no previous reviews looked at the overall research on induction machines. Moreover, there are no such studies that looked at Eastern European Journals and at the state of research in this geographical area. With the current research, we seek to fill in this gap.

This paper aims to present the main research trends on the induction machine in Eastern Europe and identify potential areas for future research. We do so by examining all papers published on this topic in six major Eastern European journals (see Table 3). We hope that our research findings will enable editors and researchers better understand the profile of Eastern European journals and their preferred research trends. Eventually, this could lead to identifying new ways to increase journals visibility and ranking performance.

The research idea was inspired by the International Electrotechnical Committee's (IEC) requirements to improve the efficiency of electric machines. The IEC 60034-30 standards for electric machines manufacturers aim to harmonize IEC's with US and Canadian normatives and define the efficiency classes for the induction motors (see Table 1). The IEC 60034-30 standards are implemented gradually (see Table 1). Based on the standards implementation agenda, we set to review all papers published on the topic between 2010 and 2017.

Table 1

Induction motor efficiency classes defined by the IEC 60034-30 standard [1, 13 –16]

Symbol	Name
IE1	*Standard efficiency class*
IE2	*High efficiency class* - mandatory since 16 June 2011 - In China and EU countries
IE3	*Premium efficiency class* - mandatory since 2011 - In USA country - mandatory since 1 January 2015 - In China and EU countries *(for motors >=7.5 to 375 kW)* *- mandatory for all motors by 1 January, 2017 (for motors from 0.75 to 375 kW)*
IE4	*Super-Premium efficiency class* - is defined in the Technical Specification IEC/TS 60034-31 (not in the 1st Edition of IEC 60034-30)
IE5	*Ultra-Premium efficiency class* - is defined in the Technical Specification IEC/TS 60034-30-2:2016

The paper is structured as follows. We start with a detailed explanation of the methodology employed to select the journals and papers we further use in this study. We then present the results of our selection and analyze research trends in induction machines based on articles from six prestigious Eastern European journals. We end the paper with a conclusion section that discusses the implication of our review.

2. EASTERN EUROPEAN JOURNALS IN ELECTRICAL ENGINEERING

The purpose of this study was to discuss the research trends on induction machines in Eastern European Journals, so we first aimed to identify the main journals in this area. In this sense, we looked at the three most prestigious rankings: JCR impact factor (Journal Citation Reports – Thomson Reuters), SJR indicator (SCImago Journal Rank) and Eigenfactor score. More precisely, we searched as follows:

- JCR (Thomson Reuters/Clarivate); we used the Science Citation Index Expanded (SCIE) (Web of Science) database and "Engineering, Electrical and Electronic" and "Engineering, Computing and Technology" search words; we then manually selected journals from Eastern European countries.
- SCImago Journal Rank: we used the Scopus database; subject category: "Electrical and Electronic Engineering"; region/country: Eastern Europe; year: 2017; ordered by: SJR.

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- Eigenfactor score: we searched the ISI Web of Science database and the ISI category “Engineering, Electrical and Electronic”; we then manually selected journals from Eastern European countries. There were no additional journals listed and all relevant journals had the EF score < 0.001, in consequence, we decided to focus on the other two ranking systems.

In order to ensure a more relevant image at the region level, we aimed to select maximum two journals from each country, those that were better ranked. We also focus on journals that were published over the whole selected period, 2010 – 2017. We ended up with 14 journals, from 10 different countries, as presented in Table 2.

Table 2

The selected journals

No	Journal	Country	Ranking factor (2017)	Issues per year	Language
1	Revue Roumaine des Sciences Techniques – Electrotechnique et Energetique	Romania	JCR: 1.114 SJR: 0.240	4	English French German Russian
2	Elektronika ir Elektrotech-nika	Lithuania	JCR: 1.088 SJR: 0.258	10	English
3	Advances in Electrical and Computer Engineering	Romania	JCR: 0.699 SJR: 0.200	4	English
4	Journal of Electrical Engineering-Elektrotechnicky Casopis	Slovakia	JCR: 0.508 SJR: 0.205	6	English
5	Informacije Midem Journal of microelectronics, electronic components and materials	Slovenia	JCR: 0.476 SJR: 0.172	4	English Slovene
6	Automatika(1)	Croatia	JCR: 0.217 SJR: 0.170	4	English
7	Advances in Electrical and Electronic Engineering	Czech Republic	SJR: 0.274	5 / 6	English
8	Archives of Electrical Engineering: The Journal of Polish Academy of Sciences	Poland	SJR: 0.233	4	English
9	Przeglad Elektrotechniczny	Poland	SJR: 0.209	2	Polish English
10	Periodica Polytechnica, Electrical Engineering and Computer Science	Hungary	SJR: 0.170	4	English
10	Elektrotehniski Vestnik/ Electrotechnical Review	Slovenia	SJR: 0.130	5	English Slovene
11	Electronic	Bosnia Herzegovina	SJR: 0.120	2	English
13	Microwave Review	Serbia	SJR: 0.117	2	English
14	Acta Technica CSAV	Czech Republic	SJR: 0.110	4	English

(1) Published in Croatia until 2016, in UK starting with 2017

All journals have English as the main language of publication. Four journals (Przeglad Elektrotechniczny, Elektronika ir Elektrotechnika, Electrotechnical Review, and Informacije MIDEM) also publish articles written in the national language. One journal, Revue Roumaine des Sciences Techniques - Series Electrotechnique et Energetique, accepts articles in four international languages (English, French, German and Russian), but not in the national language.

“Archives of Electrical Engineering: The Journal of Polish Academy of Sciences” is the only journal exclusively dedicated to the field of Electrical Engineering. All other journals are multidisciplinary, with two or more equally addressed research fields.

3. THE INDUCTION MACHINE IN EASTERN EUROPEAN JOURNALS

We further sought to have a broad picture of induction machine studies in the Eastern European Journals. We considered relevant articles that contained one of the following key words in their title: induction machine, induction motor, induction generator, asynchronous machine, asynchronous motor and asynchronous generator. We decided upon these key words because, due to its operation principle, the induction motor is also called asynchronous motor and so most authors use induction and asynchronous as synonyms [1, 17, 18].

This article is the preliminary part of an ampler research. Therefore, we focus here our analysis only on the journals that are indexed in the Thomson Reuters ranking, the most prestigious classification system. Among the initial 14 journals, six fulfilled this criterion (see Table 2).

We found 131 articles on induction machines (see Appendix), published over eight years, between 2010 and 2017, in the six selected Eastern European journals (see Table 3).

Table 3

Induction machine studies published between 2010 and 2017, in major Eastern European journals

No	Journal	JCR impact factor (2017/ 2018)	Issues per year	The induction machine articles 2010 – 2017	
				[number]	[%]
1	Revue Roumaine des Sciences Techniques – Electrotechnique et Energetique	1.114	4	36	8.63
2	Elektronika ir Elektrotechnika	1.088	10	29	1.94
3	Advances in Electrical and Computer Engineering	0.699	4	31	5.30
4	Journal of Electrical Engineering – Elektrotech-nicky Casopis	0.508	6	17	2.87
5	Informacije Midem - Journal of Microelectro-	0.476	4	1	0.35

	nics, Electronic Components and Materials				
6	Automatika	0.217	4	17	4.76
			TOTAL	131	–

4. RESEARCH TRENDS ON INDUCTION MACHINES IN FIVE EASTERN EUROPEAN JOURNALS

One of the items that we reviewed was the number of research approaches. Out of 131 articles, 94 articles (72.52 %) were based on results obtained by applying two research methods (see Fig. 1). Out of these 95, in 78 articles authors used *analytical considerations* (development of a new scheme, a new algorithm, new model, new method, and so on), in 65 articles authors used *simulations*, and in 47 articles authors did some *experimental tests*.

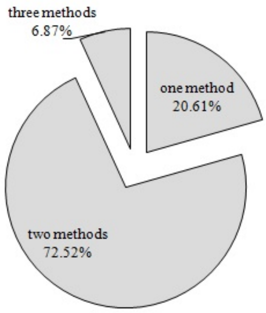

Fig. 1 – Distribution of the selected articles based on the number of the research approaches.

In other 27 articles (20.61 %), authors applied only one research method, as follows: five analytical considerations, 20 simulations and just two experimental tests. Only in nine articles (6.87 %), authors resorted to all three research methods in their study (see Fig.1).

This distribution of research methods shows that researchers prefer to develop a more intense laboratory activity as compared to focus on experimental tests.

We identified seven software applications researchers used to study induction machines. Out of these seven, five were commercial software packages, one was developed by a laboratory, and one was a freeware package:

- commercial software packages were: Matlab/Simulink (55.32 %), CedratFLUX2D (2.13 %), ANSYS Maxwell (1.06 %), Mathcad (1.06 %), MotorCAD package software (1.06 %);
- ANSIM Simulation Software was developed in the Department of Electrical Drives and Control, University of Erlangen-Nurnberg [19] – 1.06 %;
- the open source software FEMM (Finite Element Method Magnetics [20]) – 3.20 %;
- 35.11 % of the articles do not specify the simulation software / environment.

We noticed that the most applied software is the Matlab/Simulink package, 55.32 % of the articles being based on results obtained using simulations in Matlab/Simulink. This might be explained by notoriety, accessibility or simplicity of this software.

Moreover, the software packages CedratFlux2D or CedratFlux3D are more expensive than Matlab/Simulink, request more powerful computers, and their users need to have good knowledge on finite element analysis (FEM). In this sense, the distribution of the software packages used for induction machines studies may also be an indicator of the researchers' level of knowledge or of the endowment level of laboratories were these studies were carried on.

Published studied focused predominantly on rotating machines (94.66 % of the studies), only 5.34 % discussing linear induction machines. This gap could be explained by its construction characteristics and, also, by its industrial applications. In most cases, the linear machine is an open equipment with compatibility problems or / and mechanical problems. In terms of industrial applications, the linear machines could be found in applications such as machine tools, robots, electrical tractions (at experimental level) or for military applications (e.g. electromagnetic train guns or electromagnetic coils gun). The scarcity of articles that analyze linear machines might be explained either by a less developed industry that could use them or by the secrecy surrounding military applications.

Regarding the operation mode, 75.57 % of the papers discussed the induction motor and only 22.14 % the induction generator. In 2.29 % of the papers, there is no information about operation mode of machine. As a note, in the last three years, there seem to be a research trend on wind energy production, many articles focusing on the generator operation mode.

On the other hand, in 56.49 % of studies were used the squirrel-cage rotor induction motor and only in 6.87 % of these we found wound rotor induction motors. In 36.64 % of the papers, there is no information about the construction type of the rotor.

In the case of the number of phases, we identified the following distribution of applications: 3.05 % single-phase induction machines; 1.53 % two-phase induction machines, 83.97 % three-phase, 0.76 % five-phase and 7.63 % six-phases induction machine. These findings are in line with the general practice in the industry to predominantly build induction machines as three-phase squirrel-cage induction motor [2, 21].

Another result of this study was the rated power of the induction machines used in simulations or experimental tests. While we found a wide range of the rated power values (from 0.09 kW to 9000 kW), most studies (61.07 %) report on experiments using IM with lower levels of the rated power (up to 10 kW). The higher levels of the rated power (MW) were found in only around 5 % of the papers, and all these analyzed the doubly-fed induction generator (DFIG) based wind energy generation system.

We also looked at the Acknowledgment as a potential indicator of the research funding of the induction machine domain. Only 24.43 % of the studied papers had acknowledgements, which may be associated with a lack of research funding in this domain. Limited funding could further explain the lack of interest and therefore the small number of articles published on the topic.

We also aimed to understand the distribution of induction machine studies by country, so we looked at the first author's country of origin. Only four papers had authors from different countries, all other 127 being elaborated by authors from the same country. This is probably the combined result of several factors, for example, the limited level of international collaboration between researchers from Eastern European countries and the preference to publish the result of international collaborative research in more prestigious Western European and US journals.

We found a polarization at the national level, in four journals (see Fig 2), particularly Romanian and Lithuanian authors tending to publish in journals edited in their home country. In the Romanian journals, out of 67 articles, 22 have Romanian authors (interestingly, 24 articles have Algerian authors). In the Lithuanian journal, out of 29 studied papers, 11 have Lithuanian authors. In the other three journals, we did not find any Romanian nor Lithuanian authors. This might be explained through the higher visibility of the journals among home authors, but also their limited visibility among researchers from other countries.

Another aspect might be related to authors tendency to increase the visibility (and so the impact) of their national journals.

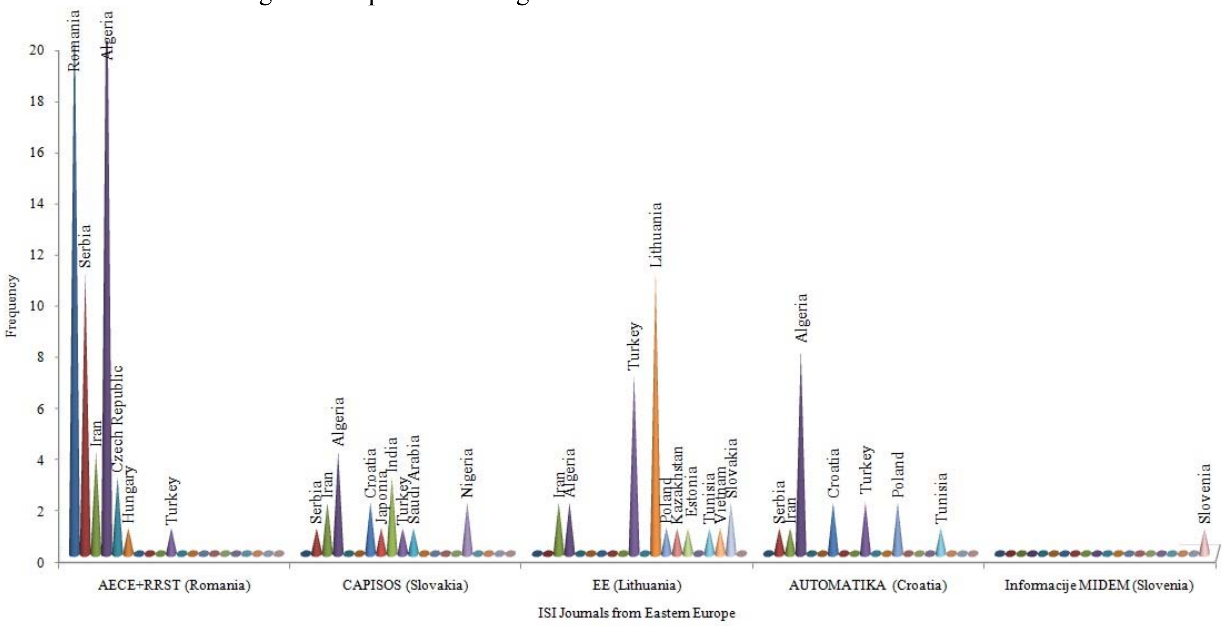

Fig. 2. – Articles published and the first author's country of origin author's.

It should be noticed the significant presence of Algerian, Turkish and Serbian researchers (Fig. 2 and Fig. 3). At the same time, other countries from Eastern Europe are very poorly represented, probably because their researchers prefer to publish in journals edited in their own countries, although these are not ISI indexed.

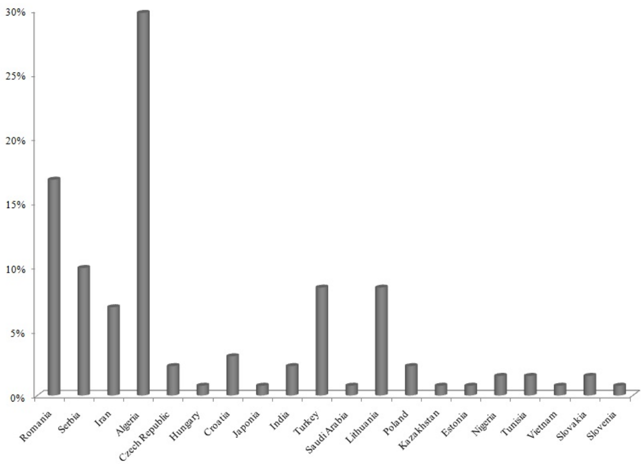

Fig. 3 – First author's country of origin.

5. **CONCLUSIONS**

Our findings show that studies on induction machines focus on their use in electrical drives, the major research interest being the torque or speed control improvement.

Surprisingly, there is a very small number of articles that focus on the high-efficiency induction motors in terms of IEC 60034-30 standard requirements. This could be explained in several ways. First, the requirements of this standard are highly applied, with strict technological solutions. For this reason, the electric machines manufacturers might have solved these requirements internally, in their own R&D departments. Moreover, manufacturers might prefer the benefits from keeping the research results secret.

Second, there might be a limited interest or potential for improvements of the induction machines efficiency. This is mostly due to the lack of funding, as in these countries, the industry is generally less developed, or is facing a fierce competition from Western European (*e.g.* ABB, Siemens) or American (*e.g.* the Brazilian motor manufacturer WEG) companies.

Finally, the very small number of the high-efficiency induction machine articles could be simply explained by the fact that this research domain is saturated, the induction machine being a very well-known product, with limited potential of radical innovations.

This research has some important contributions. First, it offers an overview of research trends in Eastern European journals and highlights main issues approached in the published articles. It also opens the discussion about visibility of these journals, both at the international, but also at regional level. In terms of performance, Eastern European journals are still less popular than Western European or American journals, but their ranking is constantly improving. A better visibility, at least at the regional level, may further help these journals improve their presence in the industry's main discourse.

This research can be expanded, first, by including in the analysis other Eastern European journals, for example those listed in Table 2. Moreover, research trends could be compared between findings in these journals and those in the most prestigious journals in the field, such as those edited by the Institute of Electrical and Electronics Engineers (IEEE).

This would reveal if research on this geographic area follows the common international trends or sets up its own agenda, answering to Eastern European specific issues.

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APPENDIX

Table 1

List of papers included in the analysis

No	Name
1) Revue Roumaine des Sciences Techniques (RRST)	
1	M. Mihalache, *Equivalent circuit parameters and operating performances of the three-phase asynchronous motor*, Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **55**, *1*, pp. 32–41 (2010).
2	V. Năvrăpescu et al, *Computation methods for space harmonic effects on single-phase induction motor performance,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **55,** *3*, pp. 278-288 (2010).
3	D. Marcsa, M. Kuczmann, *Two-dimensional modeling of the motion in induction motor with ferromagnetic hysteresis,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **55**, *4*, pp. 351-356 (2010).
4	M. Adjoudj, *Sliding mode control of a doubly fed induction generator for wind turbines,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **56,** *1*, pp. 15–24 (2011).
5	J. Radosavljević et al, *A genetic algorithm-based approach for a general steady-state analysis of three-phase self-excited induction generator,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **57**, *1*, pp. 10–19 (2012).
6	A. Kerboua, M. Abid, *Hybrid fuzzy sliding mode control of a doubly-fed induction generator in wind turbines,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **57**, *4*, pp. 412–421 (2012).
7	E. Cazacu, V. Năvrăpescu, I. Nemoianu, *On-site efficiency evaluation for in-service induction motors,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **58,** *1*, pp. 63–72 (2013).
8	A. Simion et al, *Study of the three-phase induction machine under dynamic braking,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **58**, *3*, pp. 273-283 (2013).
9	A. Idir, M. Kidouche, *RT-lab and dspace: two softwares for real time control of induction motors,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **59**, *2*, pp. 205-214 (2014).
10	Ž. Milkić, et al., *Rotor voltage influence on the characteristics of a doubly fed induction machine,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **59**, *3*, pp. 249-258 (2014).
11	A.H. Boudinar et al., *Diagnostic des défauts de roulements d'un moteur asynchrone (bearing fault diagnosis of induction motor),* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **60**, 1, pp. 39-48 (2015).
12	C.M. Gheorghe et al., *Numerical modeling approaches for the analysis of squirrel-cage induction motor,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **61**, *1*, pp. 18-21 (2016).
13	L. Mehdi, L. Barazane, *Synergetic speed control of squirrel motor drives,* Rev. Roum. Sci. Techn. – Electrotechn. et Energ., **61**, *2*, pp. 111-115 (2016).
14	T. Tudorache, I. Ilina, L. Melcescu, *Parameters estimation of an induction motor using optimization algorithms,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *2*, pp. 121-125 (2016).
15	K. Iffouzar et al., *Behavior analysis of a dual stars induction motor supplied by PWM multilevel inverters,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *2*, pp. 137-141 (2016).
16	A. Aberbour et al., *Sliding mode direct torque and rotor flux control of an isolated induction generator including magnetic saturation,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *2*, pp. 142-146 (2016).
17	A. Azib et al., *Robustness of the direct torque control of double star induction motor in fault condition,* , Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *2*, pp. 147-152 (2016).
18	S. Abdelmalek et al., *Fault diagnosis for a doubly fed induction generator,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *2*, pp. 159-163 (2016).
19	T. Benmiloud, *Proportional integrator-neurofuzzy observer of induction motor,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *3*, pp. 233-238 (2016).
20	S. Tamalouzt et al., *Direct torque control of wind turbine driven doubly fed induction generator,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *3*, pp. 244-249 (2016).
21	A. Aberbour et al., *Adaptable sliding mode control for wind energy application,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *3*, pp. 258-262 (2016).
22	F. Amrane, A. Chaiba, *A novel direct power control for grid-connected doubly fed induction generator based on hybrid artificial intelligent control with space vector modulation,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *3*, pp. 263-268 (2016).
23	F. Amrane et al., *Design and implementation of high performance field oriented control for grid-connected doubly fed induction generator via hysteresis rotor current controller,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *4*, pp. 319-324 (2016).
24	A. Maafa et al., *Cascaded doubly fed induction generator with variable pitch control system,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *4*, pp. 361-366 (2016).
25	S. Bellarbi et al., *Fuzzy robust control of double fed induction generator with parameter uncertainties,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *4*, pp. 367-371 (2016).
26	S. Meddouri et al., *Control of autonomous saturated induction generator associated to a flywheel energy storage system,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **61**, *4*, pp. 372-377 (2016).
27	V. Manescu (Paltanea) et al., *High efficiency electrical motors. State of the art and challenges,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *1*, pp. 14-18 (2017).
28	A. Benachour et al., *A new direct torque control of induction machine fed by indirect matrix converter,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *1*, pp. 25-30 (2017).
29	A. Meroufel at al., *Double star induction motor direct torque control with fuzzy sliding mode speed controller,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *1*, pp. 31-35 (2017).
30	D.R. Abjadi, D. Ghanbari, *Direct torque and flux control of asymmetrical six-phase induction motor with zero sequence components elimination,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *1*, pp. 36-41 (2017).
31	K. Iffouzar et al., *Direct rotor field oriented control of polyphase induction machine based on fuzzy logic controller,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *1*, pp. 42-47 (2017).
32	A.F. Aimer et al., *Utilisation de la méthode root-auto régréssive dans le diagnostic des défauts mécaniques du moteur asynchrone (Use of the root-AR method in the diagnosis of induction motor's mechanical faults),* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *2*, pp. 134-141 (2017).
33	A. Bouzida et al., *Experimental analysis of dynamic eccentricity in the induction machine using motor current signature analisys and discrete wavelet transform,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *2*, pp. 142-147 (2017).
34	O. Aouchenni et al., *Wind farm based on doubly fed induction generator entirely interfaced with power grid through multilevel inverter,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *2*, pp. 170-174 (2017).
35	A. Izanlo et al., *Comparative study between two sensorless methods for direct power control of doubly fed induction generator,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *4*, pp. 358-364 (2017).
36	N. Mekkaoui, Mohamed-Saïd Naït-Saïd, *Direct s-power control for a doubly fed induction generator,* Rev. Roum. Sci. Techn.–Electrotechn. et Energ., **62**, *4*, pp. 365-370 (2017).
2) Elektronika ir Elektrotechnika (EE)	
37	A. J. Poška et al., *Control and Adjustment of Linear Induction Motor Starting Force,* Elektronika ir Elektrotechnika, **98**, *2*, pp. 21-24 (2010).
38	A. Petrovas et al., *System for Measuring Speed of Induction Motor,* Elektronika ir Elektrotechnika, **101**, *5*, pp. 27-30 (2010).
39	S. Grouni et al., *Real Time Rotor Flux Estimation for Induction Machine Drives: an Experimental Approach,* Elektronika ir Elektrotechnika, **104**, *8*, pp. 69-72 (2010).
40	Y. Oner, *Thermal Analysis of the Three-Phase Induction*

	Motor and Calculation of Its Power Loss by using Lumped-Circuit Model, Elektronika ir Elektrotechnika, **104**, *8*, pp. 81-84 (2010).
41	S. Taskin, H. Gokozan, *Determination of the Spectral Properties and Harmonic Levels for Driving an Induction Motor by an Inverter Driver under the Different Load Conditions,* Elektronika ir Elektrotechnika, **108**, *2*, pp. 75-80 (2011).
42	I. Temiz et al., *Analysis of Balanced Three-Phase Induction Motor Performance under Unbalanced Supply using Simulation and Experimental Results,* Elektronika ir Elektrotechnika, **109**, *3*, pp. 41-85 (2011).
43	A. Boudiaf et al., *Mechanical Characteristics of Linear Asynchronous Motor,* Elektronika ir Elektrotechnika, **110**, *4*, pp. 21-24 (2011).
44	B. Kundrotas et al., *Model of Multiphase Induction Motor,* Elektronika ir Elektrotechnika, **111**, *5*, pp. 111-114 (2011).
45	J. Buksnaitis, *Analytical Determination of Mechanical Characteristics of Asynchronous Motors by Varying the Electric Current Frequency,* Elektronika ir Elektrotechnika, **112**, *6*, pp. 3-6 (2011).
46	R. Figura, E. Szychta, L. Szychta, *In-Service Efficiency Estimation with the use Modified Air-Gap Torque Method for Squirrel-Cage Induction Motor,* Elektronika ir Elektrotechnika, **114**, *8*, pp. 51-56 (2011).
47	M. Dogan, M. Dursun, *Reduction of Asynchronous Motor Loss by Heuristic Methods (PSOGA),* Elektronika ir Elektrotechnika, **117**, *1*, pp. 53-58 (2012).
48	B. Karaliunas, *Study on the Braking Characteristics of Linear Induction Motors,* Elektronika ir Elektrotechnika, **118**, *2*, pp. 49-52 (2012).
49	A. J. Poska, J. Buksnaitis, *Research of Cylindrical Linear Induction Motor with Unconventionally Connected Windings,* Elektronika ir Elektrotechnika, **121**, *5*, pp. 23-26 (2012).
50	S. S. Issenov, I. A. Pyastolova, *Mathematical Model of Automatic Control System for Asynchronous Multimotor Drive,* Elektronika ir Elektrotechnika, **18**, *8*, pp. 9-12 (2012).
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